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Functional Balance among Diabetic Elders with and without Diabetic Peripheral Neuropathy

[1]*Nenmanikkara Geoviya George, [2]M. S. Moosabba, [3]M. R. Sivakumar, [4]Manjula Suvarna
[1,2]Department of Surgery, [3]Department of Physiotherapy, [4]Department of Community Medicine.
[1,2]Yenepoya Medical College, Mangalore, Karnataka, India
[3]Yenepoya Physiotherapy College, Mangalore, Karnataka, India
[4]A. J. Institute of Medical Sciences and Research Centre, Mangalore, Karnataka, India

***Corresponding Author:**
Nenmanikkara Geoviya George
Department of Surgery, Yenepoya Medical College, Mangalore, Karnataka, India

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Abstract

Introduction/Backgrounds: Diabetes Mellitus is a group of metabolic diseases characterized by hyperglycaemia which is seen to negatively affect various physiological and physical functioning of the body. The purpose of this study was to understand the correlation between age, gender and functional balance in type II diabetic older adults with and without peripheral neuropathy.

Materials and Methods: The functional balance was assessed among 60 subjects with Type II diabetes mellitus fulfilling the inclusion and exclusion criteria. The sixty subjects were allotted into two groups namely, group A and group B. The subjects in the group A were type II diabetes mellitus without peripheral neuropathy (DM) and subjects in the group B were type II diabetes mellitus with peripheral neuropathy (DPM). All the subjects were assessed for functional balance using the Berg Balance Scale. For statistical analysis, the collected data was analyzed by means, standard deviation, Karl Pearson correlation coefficient, Mann-Whitney Z test and "t" test.

Results: The results showed that there is no significant correlation between age and functional balance in both the groups. In group A, males had significantly better functional balance with a score of 50.67 ± 8.39 [95% CI, 46.02-55.32] compared to female counterparts with a score of 29.80 ± 11.81[95% CI, 23.26 ± 36.37]. In group B, there was no significant correlation between gender and functional balance in both males and females.

Conclusion: The results of our study showed that there is no significant relation between age and functional balance. The results further suggest that gender has a significant correlation with functional balance among diabetic elders without peripheral neuropathy

Keywords: Diabetes mellitus, Type 2, Diabetes complications, Postural control

Introduction

The average lifespan of the Indian population has increased from 49 years to 69 years. With increased lifespan, the older adults are at a higher risk of falling down resulting in increased rate of mortality [1]. Among the Indian elderly population, the prevalence of fall was reported to be 24.98% and nearly 60.55% of them sustained injuries [2]. The main reason for falls among the older adults is noted to be type 2 diabetes mellitus [3,4]. The higher levels of HbA1c levels increases the severity of diabetic complications which thereby increases the risk of falls [5,6], balance defects [7], physical disability [8], and affects the activities of daily living (ADL) and instrumental activities of daily living (IADL) [9]. A longitudinal study found that type 2 diabetes mellitus has a negative impact on the quality of life and social

contacts [10]. There is a constant increase in the number of people being affected by type 2 diabetes mellitus. In the year 2013, 382 million people were affected with diabetes and these figures are expected to rise to 592 million by the year 2035 primarily affecting the people belonging to the low to middle income countries like India [11].

The common complication associated with diabetes is diabetic neuropathy [12], which causes muscle weakness, loss of ankle reflex, decreased postural balance, incoordination, and poor gait control [13]. Prevalence of gait variations was seen among diabetic individuals without peripheral neuropathy [14]. In a study conducted on 82 diabetic elderly women, it was reported that their gait speed and step length was decreased [15]. It was noted that postural stability [4,16,17], balance, functional mobility, muscle strength and fear of fall was severely affected in diabetic patients [18]. In a study which evaluated the relation between the presence and severity of diabetic neuropathy on balance and risk of falls found that diabetic neuropathy reduced balance and increased the risk of falls in diabetic individuals [19]. It was also observed that there was an increase in the postural sway among the diabetic patients [20]. The functional balance is seen to be adversely affected among type II diabetes mellitus. This study was undertaken as there are lacunae in the literature on the impact of age and gender among diabetic patients with and without diabetic peripheral neuropathy. The aim of this study was to assess the variation in the functional balance among patient with type 2 diabetes mellitus and comparing the results between the two groups. This would potentially help to design and tailor rehabilitation programs geared towards improving the postural control and decreasing the risk of fall among diabetic patients.

Materials And Methods

To assess the functional balance, elderly individuals above 60 years of age with type II diabetes mellitus, both males and females, with good cognition, and were willing to participate were included in the study. The subjects who were unable to understand and follow the instructions, subjects with uncorrected hearing and visual impairment, subjects suffering from terminal illnesses, subjects with respiratory dysfunction, cardiac conditions, CNS problems, musculoskeletal problems, lower extremity amputations, and severe lower limb arthritis, subjects using walking aids and subjects currently consuming medication to prevent dizziness were excluded from the study. The participants were divided into 2 groups: group A consisting of diabetic elders without peripheral neuropathy and group B consisting of diabetic elders with diabetic peripheral neuropathy. Sixty subjects were recruited, and using purposive sampling method 30 participants each were allotted to group A and group B.

The subjects were recruited from physiotherapy OPD, diabetic clinics and laboratory services from selected hospitals and nursing homes in Karnataka, India. The participants' diagnosis of type 2 diabetes and diabetic peripheral neuropathy was confirmed by a Diabetic Neuropathy specialist.

The details of participants age and gender were recorded. The institutional ethical committee clearance and informed consent were obtained for this study. The postural balance was assessed using Berg balance scale (BBS). The Berg balance scale is a 5-point Likert type of scale consisting of 14 functional tests of which 6 are static balance items and 8 are dynamic balance items. The time for the completion for the BBS was approximately 10–20 min and its score represent the subject's ability to control postural balance. The subjects were tested on the scale thrice and the best of the three trials were taken. Each test was scored by a therapist on a scale of 0–4 (0 – inability to complete the task; 4 – independent task fulfilment). The overall score is the sum of the obtained scores for each test item. The overall score of the scale is 56, and the minimal is zero. Scores of 0 to 20 represents balance impairment (high risk of fall), 21 to 40 represents acceptable balance (medium risk of fall), and 41 to 56 represents good balance (low risk of fall). For statistical data analysis, collected data was analysed by Means, Standard Deviation, Mann Whitney Z test and "t" test.

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Results

A total of 60 subjects were recruited for the study and divided into two groups. In group A there were 15 males and 15 females. In the group B there were 16 males and 14 females. The maximum number of subjects in group A belonged to the age group of 70-79 years while in group B the subjects belonged to the age range of 60-69 years (Table 1,2).

The mean age in Group A was 72.83 ± 7.4 years and Group B was 72.27± 8.2 years. The "t" test shows that there was no significant difference between Group A and Group B with respect to age (p=0.780) (Table 3)

The gender distribution among the total subjects shows the number of male subjects in Group 'A' and Group 'B' were 15(50%) and 14(46.7%) respectively. The number of female subjects in Group 'A' and Group 'B' were 15(50%) and 16(53.3%) respectively. (Table 4)

The mean score of functional balance in group A was 40.23 ± 14.6 score [95% CI, 34.77-45.70] and group B was 16.90 ± 10.27[95% CI, 13.06-20.74] respectively. The Z test shows that there is difference between group A and B, which was statistically highly significant (p=0.000). (Table 5)

The results in the table 6 showed that there is no significant correlation between the age and functional balance between both groups. In group A males were having significantly better functional balance with 50.67 ± 8.39 [95% CI, 46.02-55.32] compared to females with 29.80 ± 11.81[95% CI, 23.26 ± 36.37]. In group A there was a significant correlation of gender on functional balance. In group B there was no significant correlation of gender on functional balance between males and females (Table 6).

Discussion

The aim of this study was to understand the level of functional balance in type II diabetic older adults with and without peripheral neuropathy. Sixty subjects with Type II diabetes mellitus fulfilling the inclusion and exclusion criteria were selected and purposively divided into group A and group B. The group A consisted of subjects with type II diabetes mellitus without peripheral neuropathy (DM) and group B included subjects with type II diabetes mellitus with peripheral neuropathy (DPM). All the 60 subjects (Group A and Group B) were assessed for functional balance using the Berg Balance Scale to study the correlation of age and gender on functional balance. The data obtained were recorded and analysed statistically.

The results of the present study revealed that the number of patients belonging to age groups 60-69, 70-79 and 80-89 in group A were 30%, 40% and 30% respectively and age groups 60-69, 70-79, 80-89 and 90-99 in group B were 46.7%, 26.7%, 23.3% and 3.3% respectively which was in line with the study done by Verghese J et al (2001), which found that the diabetes was the most common cause of neuropathy (41%) in young old but was less in older old group [21].

The disease of diabetes itself may be the cause affecting postural control in diabetic patients [22]. The present study also verified this fact that balance was affected in diabetic patients irrespective of presence or absence of diabetic peripheral neuropathy. The results of the present study also showed that the functional balance was greatly affected among patients with diabetic peripheral neuropathy which was in line with the previous study [23,24].

The results by C.Y. Wang et al (2008) showed that the functional balance was influenced by age and gender in normal subjects [25]. The present study which included Indian diabetic population found that age had no significant correlation on the balance in both the groups. The previous studies have shown that gender negatively impacted the postural balance among healthy adults [26,27]. The gender was seen to be associated with the functional balance in group A as compared to group B. The results of our study showed that there was no significant correlation between age and balance irrespective of the presence or absence of peripheral neuropathy. In case of gender, males had better balance as compared to females in the absence of peripheral neuropathy but there was no significant correlation with gender in patients with peripheral neuropathy. The limitations of this study include a small number of subjects. Hence, larger number subjects are recommended for future studies. In this study the balance score was assessed using BBS which involved manual collection of data; hence it is advisable to check the

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balance using electronic machines like force plate. The use of diabetic neuropathy specific tests like nerve conduction velocity, electromyography etc should be used. In this study, we did not consider the chronicity of the peripheral neuropathy, height and obesity of the participants.

Conclusion

The results of our study showed that there is no significant correlation between age and balance irrespective of the presence or absence of peripheral neuropathy. In case of gender, males had better balance as compared to females in the absence of peripheral neuropathy but there was no significant correlation with gender in patients with peripheral neuropathy. The results of our study on functional balance among diabetic patients in relation to the age and gender could provide a preliminary reference for comparison with diabetic patients with and without peripheral neuropathy.

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	[a]Group A (n=30)		[b]Group B (n=30)	
Age groups	N	%	N	%
60-69	9	30	14	46.7
70-79	12	40	8	26.7
80-89	9	30	7	23.3
90-99	-	-	1	3.3

[a]Group A: consisting of diabetic elders without peripheral neuropathy, [b]Group B: consisting of diabetic elders with diabetic peripheral neuropathy.

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Table 2 Demographic data of participants

Mean value and Standard deviation		
	[a]Group A (n=30)	[b]Group B (n=30)
Age	72.83 (±7.41)	72. 27 (±8.20)
Number of Males	15	16
Number of Females	15	14

[a]Group A: consisting of diabetic elders without peripheral neuropathy, [b]Group B: consisting of diabetic elders with diabetic peripheral neuropathy

Table 3 Mean Distribution of age in Group A and Group B

Groups	N	Minimum	Maximum	Mean	Std. Deviation	t value	p value
[a]A	30	60	86	72.83	7.414	0.281	0.780
[b]B	30	60	92	72.27	8.208		[c]NS
Total	60	60	92	72.55	7.760		

[a]Group A: consisting of diabetic elders without peripheral neuropathy,

[b]Group B: consisting of diabetic elders with diabetic peripheral neuropathy,

[c]NS: Not significant

Table 4 The gender wise distribution of subjects in Group A and Group B.

Gender	[a]Group A	[b]Group B
Females	15	16
Males	15	14
Total	30	30

[a]Group A: consisting of diabetic elders without peripheral neuropathy, [b]Group B: consisting of diabetic elders with diabetic peripheral neuropathy

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Table 5 Comparison of functional balance between group A and group B

Groups	N	Mean	Std. Deviation	95% Confidence Interval for Mean		Mannwhitney test Z value	P value
				Lower Bound	Upper Bound		
[a]Group A	30	40.23	14.630	34.77	45.70	5.391	.000
[b]Group B	30	16.90	10.277	13.06	20.74		[c]HS
Total	60	28.57	17.191	24.13	33.01		

[a]Group A: consisting of diabetic elders without peripheral neuropathy, [b]Group B: consisting of diabetic elders with diabetic peripheral neuropathy, [c]HS: Highly significant

Table 6 The correlation between age and gender on functional balance in group A and group B

	[a]Group A (n=30)		[b]Group B (n=30)	
Variables	Value	p value	Value	p value
Age	- 0.251	0.181	- 0.247	0.188
Gender	- 0.725	0.000*	- 0.333	0.072

[a]Group A: consisting of diabetic elders without peripheral neuropathy, [b]Group B: consisting of diabetic elders with diabetic peripheral neuropathy

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